

# PATENT SPECIFICATION

Application Date : Jan. 9, 1928. No. 684 / 28.

309,393

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## PROVISIONAL SPECIFICATION.

### An Improved Process for Coating Metals.

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C. 2, a British company, and WILLIAM SINGLETON, of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, a British subject, do hereby declare the nature of this invention to be as follows:—

10 This invention relates to the manufacture of coated metals and alloys; the object of the invention being to provide an improved process for obtaining a protective or insulating coating on metals or alloys.

15 The process according to the invention, consists in treating the heated metal or alloy, in the form of sheet, powder or other suitable form, with a volatile silicon compound for example, silicon tetrachloride. Preferably the metal or alloy is heated during the process to a dull red heat. The resultant silicon impregnated product may then be annealed in hydrogen or other non-oxidising atmosphere.

20 25 One example of the process according to the invention for the treatment of metal powder is as follows. The powdered metal for example iron or an iron alloy is placed in a tube of any suitable material through which a current of inert gas is passed. The vapour of a volatile silicon

compound for example, silicon tetrachloride is then mixed with the gas current passing through the tube and the tube is heated to a dull red heat. The silicon compound is decomposed and the metal powder in the tube becomes coated with silicon or a substance containing silicon. The treatment with silicon tetrachloride is continued for a sufficient length of time which must be determined by trial and the whole is then allowed to cool.

35 In some cases it may be necessary to give the product an annealing treatment and this can be carried out in any suitable manner taking precautions to prevent oxidising the silicon coating, for example, the product may be again heated in an inert atmosphere to the required temperature and allowed to cool slowly.

40 45 The final product consists of a powder in which the particles are coated with a protective coating.

50 55 The invention is not restricted to the treatment of powdered metals but may also be used for forming a protective or insulating coating on articles of sheet metal or solid metal articles.

Dated the 9th day of January, 1928.

For the Applicants,

W. G. LLEWELLYN,  
Chartered Patent Agent.

## COMPLETE SPECIFICATION.

### An Improved Process for Coating Metals.

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C. 2, a British company, and WILLIAM SINGLETON, of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

70 75 80 85 This invention relates to the manufacture of coated metals and alloys, the object of the invention being to provide an improved process for obtaining a pro-

tective coating on metals or alloys.

In order to increase the ohmic resistance of a pure iron such as electrolytic iron, it has been proposed to heat the iron to a temperature of 600° C.—700° C. in a current of silicon tetrahydride: the process according to the invention consists in treating the heated metal or alloy, in sheet, powder or other suitable form, with silicon tetrachloride. Preferably the metal or alloy is heated during the process to a red heat. The process produces a superficial layer which may consist of silicon, or of an alloy of silicon and the underlying metal, or a mixture of silicon

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and a silicon alloy, the composition depending on the nature of the underlying metal and the temperature at which the treatment is effected. The resultant 5 silicon impregnated product may then be annealed in hydrogen or other non-oxidising atmosphere.

One example of the process according to the invention for the treatment of metal 10 powder is as follows: The powdered metal, for example iron or an iron alloy, is placed in a tube of any suitable material through which a current of inert gas (for example nitrogen) is passed. The 15 vapour of silicon tetrachloride is then mixed with the gas current passing through the tube and the tube is heated to a red heat. The silicon tetrachloride is decomposed and the metal powder in the 20 tube becomes coated with silicon or a substance containing silicon. The treatment with silicon tetrachloride is continued for a sufficient length of time, which must be determined by trial, and the whole is then 25 allowed to cool.

In some cases it may be necessary to give the product an annealing treatment and this can be carried out in any suitable manner taking precautions to prevent 30 oxidising the silicon coating, for example the product may be again heated in an inert atmosphere to the required temperature and allowed to cool slowly.

The final product consists of a powder 35 in which the particles are coated with a protective coating.

The invention is not restricted to the treatment of powdered metals but may also be used for forming a protective or 40 insulating coating on articles of sheet metal or solid metal articles.

The purposes to which metals treated in accordance with the invention may be put, are probably many, but three examples 45 will suffice. Iron powder treated in the

manner described above may be packed into an insulating tube, and may then be used as the resistor in an electric heating element. Similarly, a resistance wire for use in an electric heating element may be given a protective coating of silicon. Furthermore, the coating produced in accordance with the invention has useful acid resisting properties, and acid resisting vessels may be made of iron or iron 50 alloys coated in this way. 55

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that we make no claim to the use of the process in accordance with the invention as applied to the manufacture of cores for electromagnets, loading coils or the like, which is claimed in our co-pending Patent Application No. 685/28 (Serial No. 309,394), but what we claim is:—

1. A process for producing a protective coating on metals or alloys according to which the heated metal or alloy is treated with silicon tetrachloride. 70

2. A process according to Claim 1, wherein the coated material is annealed in hydrogen or other non-oxidising atmosphere. 75

3. Metals or alloys coated with silicon or a substance containing silicon when produced by the process claimed in Claim 1 or Claim 2. 80

4. Metal articles coated with a protective coating produced by the process claimed in Claim 1 or Claim 2. 85

5. Metal powders having a protective coating produced by a method substantially as hereinbefore described.

Dated the 8th day of October, 1928.

For the Applicants,  
W. G. LLEWELLYN,  
Chartered Patent Agent.

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